The Electromicrobiome of Oxygen Minimum Zones and its Biogeochemical significance

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The electromicrobiome may play a crucial role in the production of CH_4 via Direct Interspecies Electron Transfer (DIET) and in the biogeochemical cycling of iron in marine Oxygen Minimum Zones (OMZs). Recent studies show that electroactive *Geobacter* species and *Methanosarcinales* methanogens can form syntrophic associations where direct exchange of electrons via electrically conductive E-pili, rather than H_2 transfer promotes CH_4 generation. In natural settings, *Geobacter* are arguably the most important dissimilatory Fe (III) reducers in anoxic terrestrial and freshwater sediments but to date have been regarded as unimportant or absent in marine environs. New -omics data from the Peruvian OMZ show that *Geobacter* are in fact present and abundant in fully marine anoxic sediments and in the water column, along with methanogens that are known to take part in DIET. Molecular signatures of DIET including the Pil A pilin monomer of E-pili and C type cytochrome oxidase genes from *Geobacter* are also present. This is a significant and novel discovery that suggests electron flow from oxidation of organic carbon may be directed more towards methanogenesis via DIET as an electron sink, or alternatively to extracellular iron oxides with the concomitant release of Fe (II) and trace elements. Release of Fe (II) is crucial to N-cycling and primary production in surface waters but if enough electron flow is directed into methanogenesis by DIET, it could have profound effects on C-cycling and other biogeochemical cycles. Discerning the role of DIET in methanogenesis and Fe-cycling is key to understanding the expansion of OMZs as the world's oceans become deoxygenated due to changes in oceanic temperature, chemistry and circulation and will facilitate our understanding of how anthropogenic climate change will respond.